SUNDER LAL HORA MEMORIAL LECTURE, 1971

ORNITHOLOGY IN INDIA: ITS PAST, PRESENT AND FUTURE

by SÁLIM ALI, F.N.A., *Bombay Natural History Society, Bombay*

For practical convenience the beginning of modern ornithology in India may be taken as dating from the advent of Jerdon's *Birds of India* in 1864. This work epitomized the knowledge up to that period based on earlier publications and bird collections, chiefly in the first half of the nineteenth century and largely those of Hodgson, Blyth and Jerdon himself. The next 30 years or so were completely dominated by A. C. Hume who collected and studied birds extensively and set the pace with his journal *Stray Feathers* between 1872 and 1888. Hume's network of correspondents and collaborators spread over far-flung parts of the country continued their activities even after *Stray Feathers* ceased publication. All the accretions to knowledge during this period were incorporated in the first edition of the *Fauna of British India* series on birds whose appearance between 1889 and 1898 gave a marked stimulus to bird study in India. The next great 'leap forward' came with the publication of Stuart Baker's revised edition of the above work between 1921 and 1930 which took count of all the progress that had accrued in the intervening years.

A number of very competent ornithologists, mostly British, were active in India between the two world wars, notably Dr. C. B. Ticehurst and Hugh Whistler. The Ticehurst-Whistler partnership set the pace for scientific bird study during that period and after. The *Handbook of the Birds of India and Pakistan* by Sálim Ali and S. Dillon Ripley, now under publication, is intended to be a revision of Stuart Baker's *Fauna* in an improved format. It embodies all the advances made since the publication of that work and is an epitome of our knowledge up to date.

In the earlier days of Indian ornithology the chief accent was on collecting and classifying bird skins and eggs. This activity was necessary and justifiable so long as many parts of the country remained unexplored and the tools and techniques of purposeful field study were not sufficiently developed. With their availability the emphasis has refreshingly shifted from purely descriptive ornithology to bird ecology. The need for general specimen collecting in India is no longer valid, whereas ecological bird study offers boundless possibilities.

The problem of birds as pests in diverse situations is touched upon, and their beneficial activities contrasted. Some other bird problems of relevance to India and which call for careful study, and the efforts made in this direction by the Bombay Natural History Society, are mentioned. A plea is made for a well-planned project of research in Economic Ornithology—a subject of very special significance tc an agricultural country like ours.

INTRODUCTION

As elsewhere in the world, so in India, birds have excited the interest and curiosity of Man from the earliest times. This is testified by the frequent allusions to birds and some of their attributes in our ancient scriptures, and in

mythology, folklore and song. Though the descriptions of the birds in the ancient literature are seldom precise enough to enable specific identification, there are often references to songs and habits or peculiarities which are definitive and which bespeak the curiosity birds aroused and the aesthetic exhilaration they inspired. Within more recent historical times some of the Moghul emperors of India are well known to have been ardent naturalists and bird lovers. Jahangir in particular was an accomplished connoisseur. His Memoirs reveal him not only as a remarkably observant but also as an extraordinarily rational student of birds. A recent publication of this Academy entitled *Jahangir the Naturalist*, in spite of some regrettable editorial blemishes, is an admirable collection of annotated excerpts from the Memoirs.

A certain amount of basic groundwork in the way of collecting and describing bird skins and birds' eggs had been done in the years since the Moghul period by adventurous European travellers on the lookout for novelties to carry back home; also sporadically by servants of the East India Company in various unexplored regions of the insidiously expanding British Indian Empire —especially since the early years of the nineteenth century. But scientific ornithology, more or less as understood today, may for practical purposes be said to commence from the publication of the two volumes of the classic *Birds of India* by T. C. Jerdon between 1862 and 1864.

From a contribution on the history of Indian ornithology published in the *Journal of the Bombay Natural History Society* by the late Sir Norman Kinnear (Vol. 51: 104–10) we learn that one of the earliest of the 'modern' accounts of Indian birds was actually published in 1713 by Edward Buckley, a Company surgeon at Madras, with descriptions and drawings of 22 birds found in and about Fort St. George. Kinnear's informative account mentions several bird collectors and writers on Indian birds who followed during the rest of the eighteenth century. Many of these have left their mark on Indian ornithology either by describing newly discovered birds or by having such novelties named after them, or in other ways. The account is too long for our present purpose, but must be consulted by anyone interested in a more detailed history of Indian ornithology during the eighteenth century. Perhaps the first serious attempt at recording the avifauna of a definitive region in India in a scientific journal was a paper in the *Proceedings of the Zoological Society*, London, in 1831 by Capt. James Franklin, a geologist, who had undertaken a journey through the Central Provinces mainly to study the rocks in the Vindhyan Hills. It describes a number of species new to science at the time.

The first six decades of the nineteenth century, until the publication of Jerdon's *Birds of India*, were dominated by the virtual founders of Indian ornithology, Bryan Houghton Hodgson (British Resident in Nepal between 1820 and 1844), Edward Blyth, the Curator of the Asiatic Society of Bengal's museum, and Thomas Caverhill Jerdon, a surgeon in the Madras Army of the E.I. Co.'s

establishment. But there were a number of other active field workers during this and the period towards the end of the eighteenth century, who have been acknowledged in the Introduction to *Birds of India* and whose efforts largely contributed to Jerdon's accounts. Among the most important of these were Adams, James Franklin, John Gould, Thomas Hutton, McClelland, Sykes, Tickell and Tytler in India, and Kelaart and Layard in Ceylon. They were mostly civil or military officials in the employ of the E.I. Co. scattered widely over different parts of the country and made valuable original contributions to the ornithology of the areas where they lived and worked. *Birds of India* epitomizes the knowledge up to that period based largely on the publications of Blyth and the vast collections of skins of Hodgson (chiefly from Nepal), and of Jerdon himself and his many correspondents and protégés scattered over the country. Jerdon's work does not cover the north-western parts (now West Pakistan) or Kashmir, and likewise excludes Assam, Manipur, E. Bengal, the Andaman and Nicobar Islands, and Ceylon. Edward Blyth, the Curator of the Asiatic Society of Bengal's museum, arrived in Calcutta in 1841. He had little opportunity for field work but must rank as one of the founders of systematic ornithology in India. He was responsible for the working out and reporting on many regional bird collections of the period and describing a large number of novelties from amongst them. *Birds of India,* by bringing together and within reach of the average bird student the regionwise literature scattered in periodical scientific publications such as *Proceedings of the Linnaean* and *Zoological Societies* of London and *Journal of the Asiatic Society* of Bengal, gave a marked impetus to bird study in India. It helped to create a wider interest in birds and to build up a large circle of knowledgeable bird students in the country. It remained the standard work for many years and is almost indispensable to the serious ornithologist even today.

The period between the publication of Jerdon and its successor, the Indian Office-sponsored volumes on birds in the *Fauna of British India* series, i.e. between the years 1864 and 1898, were completely dominated by Allan Octavian Hume who had meanwhile appeared on the Indian scene. Hume, apart from being an ornithological giant, was a truly remarkable individual—administrator, scholar and humanitarian. He has the unique distinction also of being one of the original founders of the Indian National Congress while still in active Civil Service! With good justification he has been called 'The Father' —and as a dubious compliment by those who were sometimes irked by his seeming dogmatism 'The Pope'—of Indian ornithology! Hume collected bird skins methodically and extensively, himself as well as with the help of his wide network of correspondents voluminously tutored and briefed, chiefly between 1870 and 1885. His collection totalled over 60,000 skins, in addition to a vast number of birds' nests and eggs. All this material was presented later to the British Museum where a large part of Hodgson's Nepal collection of

over 20,000 skins had already found its way. Small wonder then, that, together with the many other major collections such as those of Col. Sykes, The Marquis of Tweeddale (Viscount Walden), John Gould, and others continuingly acquired, the British Museum collection of Indian bird skins has come to be the most comprehensive under a single roof anywhere in the world, and one that no serious worker can do without consulting.

Among his many preoccupations, Hume founded and edited '*Stray Feathers*—A Journal of Ornithology for India and Dependencies' between 1872 and 1888. Its 11 volumes are a veritable gold mine for the ornithologist and an eloquent testimonial to the zeal, industry and erudition of its remarkable editor. By constant encouragement, advice and goading he contrived to get the best out of his numerous band of collaborators and correspondents, some of whom are prominent names in Indian ornithology. *Stray Feathers* ceased publication after 1888, and many of its former contributors, as well as other workers who had become active meanwhile, diverted their writings to *The Ibis*—the journal of the British Ornithologists' Union—and to the *Journal of the Bombay Natural History Society*. The latter, which made its initial appearance in January 1886, has maintained unbroken publication since; it has become increasingly important as a medium for disseminating knowledge about Indian birds and is now in its 68th volume. The *Journal* has grown progressively in international reputation and scientific stature since the turn of the century, and it would be true to say that today no work on Indian ornithology (or other branch of Indian natural history) can be complete, or is indeed possible, without constant delving into its contents. Many significant contributions on birds have appeared in its pages during the last 70 years; they constitute the bricks of which our current knowledge is built.

Even up to 1925, however, almost all the ornithological contributors to the *Journal* were Britishers, chiefly Government officials from all branches of the services—Army, Civil, Police, Forest, and others—with a sprinkling of planters and business or professional men. The more prominent among these have been named in the introductory chapters of both editions of the *Fauna of British India* series on birds. Many of them continued to make valuable contributions in the years following the completion of the second edition of that work in 1930.

Ornithology in India received its second big boost after Jerdon by the publication, between 1889 and 1898, of the four volumes on birds in the *Fauna of British India* series by Eugene W. Oates and W. T. Blanford. Like its predecessor, this work brought together and up to date all the advances that had accrued in knowledge during the intervening 27 years, thanks to the extensive explorations and research in field and museum largely under the aegis of Hume and reported in *Stray Feathers*. The '*Fauna*' was also more comprehensive in that it covered the geographical areas excluded from Jerdon,

as well as Burma, thus encompassing the entire British Indian Empire as it then stood, together with Ceylon on considerations of biological affinity. The inclusion of the additional territory increased the number of species described in Jerdon by more than half, and with the substitution of Jerdon's archaic nomenclature and obsolete system of classification by what was then accepted as more rational and progressive, the *Fauna* gave a new look to Indian ornithology, and registered a marked advance over its predecessor. It was clearly responsible for the eruption of the notable crop of outstanding field ornithologists that distinguished the next 33 years up to the appearance of Vol. 1 of the second edition (the *New Fauna*), including its author E. C. Stuart Baker himself.

In my opinion the next great 'leap forward' in Indian ornithology came soon after the outbreak of World War I between 1914 and the end of 1930 when the last volume of Stuart Baker's revision (2nd edition) of the *Fauna of British India* series was completed. The First World War indeed proved a blessing for ornithology in India because it drafted into the country for varying periods, a spate of experienced and competent British field naturalists and professional ornithologists among the military personnel, who made important contributions to bird study during their sojourn in India and set the pace. Perhaps the most outstanding of such fortuitous arrivals, and one whose impact on Indian ornithology has been almost revolutionary, was Capt. Claud Buchanan Ticehurst, then already a name in British ornithology. Previous to being posted to India Ticehurst had spent a couple of years with the Royal Army Medical Corps in Iraq where, in collaboration with some other British army officers temporarily 'at war' like himself, he had collected and studied birds extensively. As a result of these activities they jointly produced a comprehensive account of 'The Birds of Mesopotamia' (JBNHS 28: 210–50; 381–427; 650–74; 937–56) which still remains a basic source of reference for that country. Dr. Ticehurst arrived in India in October 1917 and was stationed in the military hospital at Karachi until January 1920. He soon gathered round him a band of knowledgeable bird watchers and correspondents including a number of seasoned British amateurs already resident in the country. While in Karachi Ticehurst made use of his opportunities to collect specimens and notes and observations on the birds of the province as well as of adjoining Baluchistan and Punjab. This material, collated with random previous publications, forms the basis of his paper 'On the Birds of Sind' published in *The Ibis* in eight parts between 1922 and 1924. That paper is a classic—a model of what a regional bird paper should be, and contains copious notes on ecology, habits, migration, avifaunal affinities and taxonomy. It has had a vitalizing impact on authors as well as editors of similar bird papers published in India since that time—including my own—and the new approach has helped to alleviate somewhat the intrinsic dry-as-dust quality of such

essential regional lists. No work of comparative thoroughness and authenticity has been done in West Pakistan before or since. Indeed, in the last 50 years or so, little of significance has emerged from that Province, and in spite of the vast changes in ecology that are taking place in the country as a result of industrialization, irrigation and other development, Ticehurst's paper still remains the most comprehensive account of the birds of Sind.

One of Ticehurst's closest associates and co-workers during this period and later was Hugh Whistler who, like Stuart Baker, was an officer of the Imperial Police Service. He came out to India in 1909 and spent most of his service in Punjab, retiring prematurely in 1926. During his 17 years in the country he collected birds intensively and methodically; he amassed voluminous field notes on the bird life of his Province and published a series of extremely useful regional and other papers dealing with Punjab birds. Whistler was every bit as careful and critical an observer and meticulous a museum worker as his friend and mentor. And so invigorating was the impact of these two men on Indian ornithology during the period between the end of World War I (1918) and their untimely deaths—Ticehurst in 1941 and Whistler two years later in 1943—that it would not be inappropriate to term this the Ticehurst-Whistler Era.

To coordinate and synthesize the advances made in our knowledge of geographical distribution, nidification, relationships, taxonomy and in other fields of study during the 33 years in which Oates and Blanford had held the field as the standard reference, the need for an updated edition of that work became imperative. E. C. Stuart Baker, a retired senior police officer and a very knowledgeable ornithologist, undertook the ambitious task of revising it. Baker had spent the major part of his long service in Assam; he had devoted much time to the collecting and field study of birds, especially their nidification, and made valuable contributions to the ornithology of his Province, including some remote and till then totally unknown tracts. The six main volumes which comprise the *New Fauna* were published between 1921 and 1930. In spite of obvious shortcomings and blatant errors (for which his critics were ruthlessly unsparing) due largely to the fact that he was personally unfamiliar with many of the geographical areas he was writing about—there is no doubt that by and large the *New Fauna* registered a distinct advance over its predecessors. To Baker must also go the credit for introducing the subspecies concept in a standard work of Indian ornithology for the first time, officially as it were, though the system had been in vogue in the West since almost two decades previously. Views of working ornithologists in the country at variance with Stuart Baker's found expression and strong support in Ticehurst's well-documented critiques of the *New Fauna*.* They drew

* 'Some notes on the second edition of the *Fauna of British India*—Birds', Vols. 1 and 2—*J. Bombay nat. Hist. Soc.*, **31**: 490–99; Vol. 3, ibid., **32**: 344–56; Vol. 4, 5, 6, ibid., **34**: 468–90.

pointed attention to the fallacy or dubiousness of many of the author's statements and assumptions often based on faulty premises or mere conjecture. The criticisms focused on the fact that there were sizeable areas of the subcontinent still very insufficiently explored ornithologically. Since a correct knowledge of geographical distributions of bird populations is basic for a proper understanding and application of the subspecies concept, it was felt that systematic bird surveys and planned specimen collecting in the blank areas was a prime necessity for putting the record in order.

The Ticehurst-Whistler Era was fortunate also in having a number of other keen and knowledgeable field ornithologist living in India who by their activity in the areas of their special interests added significantly to the progress of the discipline. The names of Sir Norman Kinnear (later Director of the British Museum, Natural History), Frank Ludlow, B. B. Osmaston, A. E. Jones and Chas. M. Inglis stand out amongst this group.

A beginning towards removing the deficiency pinpointed by Ticehurst of large unworked parts of the country, was soon initiated by the Bombay Natural History Society. With the financial sponsorship of Mr. Arthur Vernay, an American business magnate and big game hunter, who was also a generous patron of scientific exploration, a well-planned bird survey was carried out between 1929 and 1931 of the Eastern Ghats, at that time one of the least known areas in the Peninsula. The extensive collections of the the Eastern Ghats, Survey, critically studied by Whistler and Kinnear with the collaboration of Ticehurst, form the basis of the scientific report published in 16 parts in the *Journal of the Bombay Natural History Society* (Vols. 34–39, 1930–37). This is undoubtedly the most important systematic paper on Indian birds following on the publication of the *New Fauna* and amply vindicates the need for methodical selective specimen collecting in imperfectly known areas. It served as incentive and model for further work on the same lines in other parts of the country. Thus there followed a succession of field surveys between 1930 and 1950 covering the following areas in that order: Jodhpur, Hyderabad, Travancore, Cochin, Central India (Gwalior, Bhopal, Indore, Dhar), Bahawalpur (Punjab), Mysore, Kutch, Gujarat, Bastar, Kanker and Orissa (including the former Eastern States Agency). Furthermore between 1950 and 1969 a considerable amount of organized collecting and other field work had also been done in Nepal, chiefly by Biswamoy Biswas of the Zoological Survey of India, Walter Koelz, an American ornithologist, and R. L. Fleming, a resident American missionary. Similar field work had been undertaken in Sikkim, Bhutan, NEFA, Nagaland and Manipur by Dillon Ripley, Biswas and myself. Besides the large number of bird skins selectively procured in places whence practically no fresh or properly documented study material existed, all the above surveys were of particular scientific importance because of the special attention paid in the field throughout

to ecological problems. In what may be called the *ad hoc* collecting of the past, little consideration was given to this aspect since the skins were amassed mainly with the help of local shikaris or persons without the requisite scientific background. With the exception of the Eastern Ghats and Jodhpur surveys, practically all the rest of the field work was conducted by me personally. Since my own special interest lies in the *living* bird, in problems of bionomics and ecology, it can be claimed without undue modesty that these reports are richer in ecological content than most previous work of this type. The scientific results of all these surveys have been published in various journals, or are under preparation, either by myself or jointly with Whistler, Ripley and others. They have also provided the bases for my books on the *Birds of Kutch*, *Birds of Kerala*, and *Birds of Sikkim*; largely also for the comprehensive 10-volume *Handbook of the Birds of India and Pakistan* under the joint authorship of myself and Dillon Ripley. This work, sponsored by the Bombay Natural History Society and published by Oxford University Press, is intended as a revision and in replacement of Stuart Baker's *Fauna* which is both out of date and out of print.

Most but not all the gaps in our knowledge of the distribution of indigenous or resident birds have been fairly adequately plugged by the surveys, and we are now in a much surer position than Baker was 40 years ago. Thus the need for a further revision and updating of the *Fauna* was obvious enough. But a somewhat different format was called for, providing scientifically accurate concise accounts in non-technical language, of life histories and ecology supplemented by simple clues to field identification and, above all, good coloured illustrations. In other words what seemed urgently needed was a popularization of Indian ornithology. That so little interest exists among our countrymen in bird watching or scientific ornithology even today, and that practically all the work in the past was done by Europeans, has been largely due to the lack of simple illustrated books on Indian birds. Since the first appearance of Whistler's *Popular Handbook of Indian Birds* in 1928 and my own *Book of Indian Birds* in 1941, and several others since, a steady increase in general interest in birds and bird watching has become abundantly evident. It has affected all levels of society and all age groups and it is to be hoped that with increasing facilities some of the youthful enthusiasts of today will develop into competent ornithologists in time. Bird watching is one of most enjoyable and satisfying of outdoor hobbies and also one of the least expensive. The only comparatively costly item of equipment needed, but one which is essential for getting the fullest value from ones opportunities, is a good pair of field glasses. Pencil, paper and patience (in generous quantity) are the only other requisites for purposeful bird watching.

At the graduate and postgraduate levels, as far as I am aware, the universities of Bombay and Baroda are the only two in India that offer

facilities for advanced study in birds. Since 1958 the Bombay Natural History Society has been recognized by the University of Bombay as an affiliated guiding institution for postgraduate research in Field Ornithology (which includes ecology, bionomics and other extramural studies) leading to the M.Sc. and Ph.D. degrees. Unfortunately, however, the response from both students and the Society has been somewhat lukewarm, and understandably so. From the student's point of view because there are, as yet, no alluring job opportunities in India for qualified ornithologists; from the Society's because there are exceedingly few applicants possessing the necessary basic background for achieving worthwhile research within the two or three years which most students are prepared to work before expecting their degree. An intelligent and active interest in birds from an early age, and ability to identify them in the field, plus a grounding in general textbook zoology are the absolute minimum qualifications for attempting purposeful ornithological research of this kind. Field identification is, indeed, the ABC of the study of free-living birds, and unless and until a certain level of proficiency in this is attained there is little possibility of ecological research being successfully attempted.

Until not so long ago bird watching as such was looked down upon by professional zoologists as a childish way of killing time by the idle rich, and of no scientific importance. To acquire respectability in their eyes, and appear truly 'scientific', one had to collect bird skins and eggs—the larger and more wide-ranging your collection the more respect did you command. In other words, collecting and classifying specimens were considered the essence of scientific ornithology. Up to a point the overwhelming emphasis on specimen collecting in the early days was perhaps justified; before one can begin to learn about an organism one must identify it and be able to recognize it from amongst other similar-looking and seemingly related organisms. In this, bird study in India had followed the pattern set by the more advanced western countries. The classification work had to be done mostly by museum specialists, first of the Asiatic Society of Bengal and later by those of the Zoological Survey of India, Calcutta. Thus the bulk of the activities of the earlier upcountry amateur ornithologists were confined largely to the mechanical collecting of bird skins and eggs for vicarious identification in the museum. It is true that large collections of bird skins and eggs from different parts of the country were basic material, and no progress in the study would have been possible without them. But most amateurs had gained the mistaken impression that collecting skins and the publication of local bird lists was the sum total of the contribution they could make, and beyond that—the real 'scientific' contribution—was the province of the professional museum zoologist. However, a time came when sufficient dead material had stock-piled in the larger museums of the world—available on loan to serious workers—not to need further general collecting except in limited unworked pockets or

imperfectly explored areas, and selectively of the lesser known groups or species of birds. In the meanwhile, as indicated earlier, significant advances had been taking place in the tools, techniques and purposefulness of watching free-living birds. The perfection achieved by sophisticated optical instruments such as binoculars, telescopes, high speed cameras, telephoto lenses, electronic flash and other equipment, together with the advent of colour illustrated regional field guides on birds had done away with the necessity of killing merely for identification, and also opened up vast opportunities for purposeful bird watching which the accent on ecology had rapidly elevated into scientific respectability. Bird ecology in its broadest sense includes all environmental relationships: physical factors, biotic influences such as habitat, intraspecific contacts such as social structure and population dynamics, and interspecific relationships such as symbionts, predators and parasites. Ecological research has released ornithology from its confines within the walls of the museum and out of the stereotyped rut of morphology and taxonomy into which it had fallen. It has imparted a refreshing new look to the science and opened up limitless horizons for the field naturalist and student of the living bird. A good field ornithologist today must be a compound of many specialization, or at least of well-informed awarenesses, of a wide range of scientific disciplines. A glance through the contents of any modern ornithological journal—the British *Ibis*, the American *Auk*, or the German *Journal für Ornithologie*, for instance—will show the vast field that present-day ornithological research covers. It involves not only systematics, genetics, behaviour, vocalization, biometry and statistics, but also related disciplines such as botany, physics, chemistry, geography and others—in fact it is biology in its widest sense. Much of the work has necessarily to be of a cooperative nature involving coordinated teamwork of ornithologists with specialists in other field; it has reached a high degree of sophistication. In the wake of these world trends, Indian ornithology has also made some significant progress since 1930 when the last volume of Stuart Baker's *Fauna* was published. Some of the developments in the Ticehurst-Whistler Era have already been referred to. Since the deaths of these two, the interests of Britishers seems to have drifted away more or less completely from the Indian scene of Africa. This is evident from the spate of papers on African ornithology appearing in the *Ibis* since that period, almost completely displacing India which formerly figured so largely in that journal. There has, however, been a marked increase in American interest in Indian birds in recent years, and a number of important expeditions have been undertaken by American ornithologists to various remote and unexplored parts of the country, especially in NE. India. The most prominent of these are Dr. Walter Koelz and Dr. S. Dillon Ripley, each working independently or in collaboration with Indian colleagues. In Dr. Biswamoy Biswas of the Zoological Survey of India, we now have a thoroughly com-

petent taxonomer who is rapidly bringing up to date the long-neglected bird collection of the Zoological Survey of India containing some of the oldest historical Indian material and type specimens. It has also made us more self-reliant, and lessened the need for dependence on foreign experts and museums for elucidating our taxonomical problems.

Though still a good way behind some of the more advanced countries in the diversity and sophistication of ornithological research, India seems at last to have got out of the taxonomical rut, and a large list of ecological problems is receiving, or has been earmarked for receiving, the attention of researchers. The breeding biology and population dynamics of several species have been commendably investigated or are under study, particularly of such birds as have been incriminated as agricultural pests. In a country like India which leans so heavily upon her forests and agriculture, research on the economic status of birds that have a direct bearing on these industries is obviously of the greatest importance. The double-sided activities of many species, making them pests in certain situations and benefactors in others, make a study of their complete life histories essential. For a realistic assessment of their overall impact a precise knowledge of their food and feeding habits and their biomass and population dynamics is crucial. Yet the only serious attempt in this direction, which however deals mainly with the insect food of birds in an intensively cultivated area in Bihar, was done as far back as 60 years ago.* Though covering only a part of a bird's activities, the findings clearly demonstrate the importance and usefulness of this kind of research—Economic Ornithology—which the Bombay Natural History Society is actively advocating to the Planning Commission for being taken up seriously at the various agricultural universities in the country. Diurnal Birds of Prey and Owls are generally accused of ravages to poultry but the untold good they do in keeping the devastatingly fecund rodent populations in check is forgotten. Similarly fish-eating birds like Herons are charged with depredations on commercially valuable fishes, but their good offices in the destruction of predator fishes, which are far more harmful to the fry of the valuable species, ever go unthanked. Two other ecological problems in India worthy of intensive investigation, and in which I have been deeply interested, are flower-pollination and seed dispersal through the agency of birds. The little preliminary work so far attempted has clearly demonstrated the potentialities and the need for more thorough research. It may be of interest to know that birds are mainly responsible for the fertilization of the flowers of the Silk Cotton (*Salmalia malabarica*) and thus for the natural regeneration of the tree whose wood is considered to be one of the most suitable indigenous species

* 'The Food of Birds in India' by C. W. Mason and H. Maxwell-Lefroy. *Memoirs of the Department of Agriculture in India*, Pusa (Entomological series), Vol. 3, 1912.

for the manufacture of safety matches. Similarly, to the seed-dispersing activities of many frugivorous birds is due the abundance of the mulberry tree (*Morus*) in Punjab, whose wood is the basis of our flourishing sports goods industry. In the year 1969 India exported over a crore and 25 lakh rupees worth of sports goods to foreign countries, and the figure is expected to reach two crores soon; and all this, at least in considerable measure, thanks to the birds. On the debit side of the pollination and seed-dispersal account may be entered the mischievous plant parasites of the mistletoe family—*Loranthus* and *Viscum*—which cause considerable damage in orchards and forest plantations—notably to mango and teak trees. The explosive flowers of many of the Loranthaceae are fertilized exclusively by sunbirds (Nectariniidae) and other specially adapted nectar-eaters; the viscous seeds of both parasites are excreted and the infestation spread from branch to branch and from tree to tree largely by flower-peckers (Dicaeidae).

In recent years, with the advent of jet aviation, birds of many different species and sizes and habits have become increasing hazards to civil and military aircraft. Large birds like vultures and kites cause serious accidents by direct strikes, and small birds, especially when in flocks, by being sucked into the air intake of the jet engines. In either case, even if they do not result in fatal crashes, they necessitate very expensive repairs or even the complete scrapping of costly engines. A great deal of research is in progress in Europe and America along diverse lines to find some remedy for this mounting menace. The Bombay Natural History Society frequently receives mangled remains of birds recovered from damaged jet engines of military aircraft for identification. This hazard is bound to increase in India with further development of jet flying. As yet no satisfactory solution has been suggested anywhere though a variety of local measures are found to be moderately effective—but only for a time.

In the Introduction to *Proceedings of a Symposium on the Problems of Birds as Pests* held in London in 1967, the Chairman, Sir A. Landsborough Thomson, observed: 'Birds are to a large extent economically beneficial; they are also, of course, scientifically interesting and aesthetically delightful. Yet some species tend to be harmful, and others become pests when present in excessive numbers or in the wrong places. The task is, dispassionately and objectively, to determine the facts and consider what to do.' In fact, as the Preface to a similar more recent publication* says: 'All programs for controlling the populations of animals, whether they limit birth rates or increase death rates, must strive to be specific for target species or individuals. They must be ecologially sound, socially acceptable, and harmless to the remaining biota, including man.'

* *Principles of Plant and Animal Pest Control*, Vol. 5. Vertebrate Pests: Problems and Control. U.S. National Academy of Sciences, 1970.

One of the lines of ornithological field research in India in which the Bombay Natural History Society has been actively engaged since 1960 is the study of Bird Migration. In spite of the fact that seasonal bird movements to and from this country take place on such a colossal scale twice each year, involving millions of individuals and some 300 out of the 1,200 species on the Indian list, the scientific data we possess concerning this phenomenon are exceedingly meagre. Such information as was hitherto available rested largely upon somewhat sporadic and disconnected visual observations of British civil and military personnel stationed for various broken periods along the NW. Frontier of prepartition days, chiefly during the 80 years or so prior to our independence. Many of these observers were excellent naturalists and their contributions to our ornithological knowledge of those remote areas are unique. Their observational data though primarily relating to sporting birds such as ducks, geese and cranes form the hard core of practically all we know of trans-Himalayan bird migration. They outlined the broad pattern of the seasonal movements and suggested that the main bird migration route between Siberia and central Asia on the one hand and the Indian peninsula on the other was the Indus Valley in the northwest. Similar though even more fragmentary bits and pieces of information from our north-eastern outposts suggest that from north-eastern Asia the Tsangpo or Brahmaputra river and its affluents may constitute the principal flyway. The two migrational streams, entering from either end of the Himalayan mountain chain in a pincer movement, converge on the tip of the Peninsula, weakening as they advance southward and trickle over into Ceylon which virtually forms the terminus. However, increasing evidence provided by mountaineers in recent years indicates that considerable movement also takes place directly over the Himalayan barrier often at very great heights. It is probable that the extent of such direct crossing may be far greater than suspected, since it would have the crucial advantage for the birds of shortening their journeys very considerably. This being the elementary state of our knowledge, and with little early hope of the situation improving for lack of funds and facilities, it was indeed a lucky windfall for India when the World Health Organization came forward with an offer to sponsor a project of the Bombay Natural History Society for bird migration field research. The offer was apropos of a 'mysterious' and hitherto unrecognized virus disease afflicting villagers and monkeys which had apparently erupted in the Kyasanur forest area of Shimoga district, Mysore—whence named Kyasanur Forest Disease (KFD). The virus, investigated by the Virus Research Centre, Poona, showed close antigenic relationship with Russian Spring-Summer Encephalitis (RSSE) with focus in western Siberia. Viruses of this group are carried by arthropods—mosquitoes, ticks, mites, etc. [and hence designated arboviruses (abbreviation of 'arthropod-borne')] many species of which are parasitic on birds. Since

a large number of our migrants are known to derive from Siberia, it seemed rational to conclude that birds may in some way be involved in the transmission of this virus to India. A proper knowledge of their precise routes and movements outside the country, as well as their dispersal patterns within, could, it was felt, lead to suggestive clues about the areas of infection, etc. The BNH Society's activities during the 11 years since they began in 1960—latterly in collaboration with the Smithsonian Institution, Washington —have consisted of the methodical netting and ringing of birds, chiefly migratory, and collecting from them ectoparasites as well as blood smears and sera for identification and virological studies. The field camps are so deployed as to provide the widest possible coverage of the country within the resources available. The two more or less permanent stations at present are in Bharatpur (eastern Rajasthan) and at Point Calimere on the south-eastern coast in Tamil Nadu, opposite Ceylon. Over 200,000 birds of many Orders and Families have been handled and ringed to date. A small percentage of these, recovered outside our limits as well as within the country, have yielded extremely valuable data on ecology, geographical distribution, and movements, etc., which could not have been procured except through the marking of individual birds. Actual virological investigation is beyond the present scope and competence of the Society; it is being conducted by our collaborators the Virus Research Centre, Poona, and by cooperating specialist agencies in the USSR. The KFD virus, in the dissemination of which birds are suspected to be involved, is one of the two or three in India on which intensive epidemiological studies have been undertaken to understand the role of extra-human hosts, including birds. However, though isolations of certain other viruses have been made in Poona from bird-infesting ticks, it is interesting that the search for KFD virus from large numbers of ticks and birds collected in the KFD-affected area in Mysore has so far yielded no positive evidence. And this despite the fact that earlier studies of sera from birds had revealed a comparatively high percentage with neutralizing activity for KFD virus. Neutralizing antibodies to KFD virus have also been reported in the sera and blood smears of birds from India examined by the Pavlovsky Virological Laboratory, Moscow, and the Institute of Diseases with Natural Foci, Omsk. But the problem is still under investigation.

This account brings us more or less up to date with ornithology in India. One can look to the future with hope and confidence. The visible growth (or upsurge, if that is the right word) of popular interest in birds and bird watching in India side by side with improving living standards of the people is a refreshing sign. It is but a short step from purposeful bird watching to scientific ornithology. It is to be hoped that with official encouragement to bird study at all levels in educational institutions, and creation of adequate job opportunities, ornithology in India will come into its own and march in step

with the progress and sophistication which the discipline is achieving in some other parts of the world.

References

Ali, Sálim, and Ripley, S. D. (1968). *Handbook of the Birds of India and Pakistan.* Oxford University Press, Bombay (Vol. 1, Introduction).

Baker, E. C. Stuart (1922). *Fauna of British India: Birds,* 2nd edition. Taylor and Francis, London (Vol. 1, Introduction).

——— (1932). *The Nidification of Birds of the Indian Empire.* Taylor and Francis, London (Vol. 1, Introduction).

Jerdon, T. C. (1862). *The Birds of India.* Self-published, Calcutta (Vol. 1, Introduction).

Oates, Eugene W., and Blanford, W. T. (1889). *Fauna of British India: Birds,* 1st edition. Taylor and Francis, London (Vol. 1, Preface).

(Other relevant references cited in the text.)